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## A GROUPING OF THE AGROTINE GENERA

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The Agrotines have always been a difficult region in our classification of the Noctuidae. While perhaps not as complete a mystery as the series called Acronyctinae by Hampson, there has never been any agreement as to the content of the group, the manner of subdivision, or the relative importance of the various characters. There has been a tendency to make arrangements frankly artificial, and where the published statements seem to imply a certain amount of natural grouping<sup>1</sup> these groupings agree neither with each other, nor wholly with the only well marked larval character, the rough or smooth skin. There are two other questions which are rather of

<sup>1</sup>In Hampson's case the presentation of a phylogeny implies that a natural system is intended, but he puts forms in fact just as they would go according to his key-characters, frequently in violation of well known larval and other characters, and the "phylogeny" would appear to be really intended merely as a key to his seriation of genera. In the case of McDunnough's revision (Bull. no. 55, National Museum of Canada) the arrangement is also in part confessedly artificial but certain groups appear to be presented as natural in the discussion on p. 19, namely *Euxoa* to *Pseudorthosia*, *Trichosilia* to *Actebia* or less definitely to *Euagrotis*, *Metalepsis* and *Cerastis*, *Hemipachnobia* to *Pseudospaelotis*, with *Peridroma* (attached to the first group), *Diarsia* to *Anomogyna*, *Trichagrotis* to *Mimobarathra*, *Adelphagrotis* to *Pseudoglaea*, and *Cryptocala* to *Pronoctua*, the two latter groups again taking up the *Euxoa* series.

nomenclature than of taxonomy in the true sense, namely as to the proper size for genera, and the names to apply to them. In the first case I should go much less far than McDunnough in subdivision, believing that a somewhat larger genus is of more use to the general entomologist, and that the minute subdivision that the taxonomist desires can best be accomplished by subgenera. I have suggested a list of some 20 genera, representing the principal structural types and the most striking aberrant ones, but there is a good deal to say for the general European custom of putting all the normal members of the series in a single genus (*Agrotis*). There is of course no justification for the equally common European custom of making a separate genus for the yellow-winged ones (*Triphaena*) as they are not at all a natural group. As to the names to use, I have followed McDunnough's list for convenience of cross-reference, in the case of what I consider mere subgenera, but have been unwilling to drop the traditional name of *Noctua*, and so have applied it to the genus to which it has on the whole been most consistently applied, on the ground that it is suitable for a conservanda ruling. So I shall use it for the group containing *triangulum* and *c-nigrum* (*Graphiphora* of McDunnough, etc.) though frequently using the name *Graphiphora* when referring to McDunnough's revision.

The present paper leans heavily on McDunnough's revision (cited in the first footnote). I will limit myself in general to his genotypes, as in a good many cases where I have studied other species which he places in the same genus, I agree that they are too closely related to worry over. In the case of North American material I shall consider the same series of forms, since on the whole they represent a natural subdivision, but have expanded the view to include a number of the more important genotypes from Europe and particularly a batch of material from South America, which gives a much clearer idea of the more primitive members of the tribe. Following McDunnough I exclude the Heliothids, which will probably make a good tribe, though my belief is that the connection between *Rhodophora* and *Agrotis* is not a distant one. As to the *Copablepharon* and *Agrotiphila* groups, which he excludes, I am not so sure that they should be omitted, but I lack material, and particularly the material from the old world, which is needed for their real understanding. The eastern palaeartic and old world tropics have been omitted from lack of material. The only American genus I have added is *Manruta*, on Benjamin's suggestion. It proves to be a true *Agrotine*, related to *Eucoptocnemis* and the South American *Tripseuxoa*.

Several genera with hairy eyes might be brought in question. *Trichosilia* and some species of *Pachnobia* have light hair, and their other structures show plainly that they belong with *Agrotis* and the normal naked-eyes *Pachnobias*, respectively. In the case of the genera with heavily hairy eyes, there is no question that they are aberrant *Poliinae*, where their genitalia fall into place. I have kept them in the tabulation because they were included by McDunnough. Another aberrant group are *Anytus*, with its European cousin, *Cyrebia*, *Fishia* and *Ufeus*. These seem also not to be true *Agrotids*, though *Ufeus* in particular has something in common with the *Agrotis* group. I treat them as a separate group, but suspect they will eventually have to go with the "Acronyctinae."

It is assumed that McDunnough's selection of genotypes is in accordance with the rules; in two cases I have used other names where a conservanda ruling would seem to be in order; *Noctua*, already mentioned, and *Naenia*, whose type under an absolutely literal interpretation becomes the type of *Phalaena* Linnaeus.

Only a few of the South American types are included in the tabulation, but in an appendix I have attached a discussion of a number of other forms, probably sufficient to give the character of the fauna. They seem to include an interesting series of aberrant members of group II, and suggest that South America will turn out the home of the most primitive types. *Peridroma* (*Hemieuxoa*) *polymorpha* in fact is perhaps the most primitive in genitalia yet discovered, being only challenged by *P. margaritosa* which also includes South America in its range. The new *Tripseuxoa carneata* and *Agrotis orestica* are interesting and highly aberrant reduction forms, and the other members of *Hemieuxoa* link to *Anicla* in one way and to *Loxagrotis* in another.

Believing that we have at present no reason for assuming any one character is more important than another in this series, I have made the trial of grouping them on the basis not of single characters selected beforehand as primary, but by giving equal value to all the characters which were sharply enough defined to handle in a tabular way, hoping to find groups based on the maximum number of resemblances. This method has made a series of groups which can hardly be defined on tangible single characters, or perhaps even on manageable groups of characters, but I believe has produced an arrangement more natural than any yet attained. At least it has set off one and perhaps two groups which show tangible larval characters.

My procedure was to make up a standard list of characters for

each genus, and then determine the number of differences between *each* two genera, regardless of supposed relationship;—then I attempted to get them into a linear series so that the differences between successive genera should be as small as possible. It was found that by cleaving them first into three main groups, it was possible to arrange the contents of each group in a nearly linear fashion. These three main groups might be considered to surround *Agrotis* or *Feltia*, *Diarsia* or *Ochropleura* (*cynica* or *plecta*), and perhaps *Anomogyna* or *Aplectoides*. There were half a dozen genera which seemed to make a subgroup by themselves, though closely related to the *Anomogyna* complex, and finally a few which refused to enter the system, but stood rather equally apart from all these groups: *Anytus*, *Fishia*, *Ufeus* and *Cyrebia*; *Trichorthosia*, *Mimobarathra*, *Trichofeltia* and *Trichagrotis*.

The only North American genus that I have not studied is *Aplectoides*; Mr. Benjamin having kindly lent me from the National Museum all the others which were missing at Cornell. In most cases the genotype was studied, but in the following other species were used: *Mesembreuxoa facicola* Dyar in place of *chilensis*; *Loragrotis acclivis* in place of *proclivis*; *Eucoptocnemis tripars* in place of *fimbriaris* (a mere subspecies); *Spaelotis clandestina* in place of *ravida*; *Epipsilia grisescens* for *latens*; *Chersotis juncta* for *rectangula*; *Pachnobia okakensis* for *carnea*; *Adelphagrotis indeterminata* for *stellaris*; *Fishia exhilarata* for *enthea* (*evelina* showed some differences), and *Ufeus hulsti* for *satyricus*. For *Aplectoides* the characters were taken from McDunnough, and two small points not mentioned by him were assumed to be normal.

The following characters were tabulated:

Eyes: naked or hairy (the rudimentary hair of *Trichosilia* got half a count).

—: lashed or not; giving half a count to forms with rudimentary lashes.

Front: 1, smooth;  $1\frac{1}{2}$ , slightly rough; 2, rough and rounded out;  $2\frac{1}{2}$ , traces of a ring; 3, a raised ring. (The double ring of *Proragrotis* was not distinguished).

Male antenna: 1, simple, shortly ciliate,  $1\frac{1}{2}$ , suberrate and fasciculate; 2, strongly serrate (*Euxoa*);  $2\frac{1}{2}$ , narrowly pectinate (*ypsilon*); 3, plumose (*monochromatea*).

Vestiture: forked, simple and mixed were each considered separated by one count; intermediate types sometimes got a half-count, but the different degrees of mixed vestiture were not separated.

Thoracic tufting: present or absent; very weak or vague tufting being given half a count.



Fore tibia: 1, unarmed;  $1\frac{1}{2}$ , a few rudimentary spines; 2, spines about  $\frac{1}{8}$  or  $\frac{1}{6}$  length of tibia and not very stout;  $2\frac{1}{2}$ , spines  $\frac{1}{4}$  or  $\frac{1}{3}$  length of tibia; 3, a claw half the length of the tibia or very massive.

Mid and hind metatarsi: upper spines present or absent; if only one or two spines were present or the middle or hind tibiae were unarmed a half-count was given.

Male genitalia—Uncus: heavily tufted, densely hairy or with sparse loose hair only (half a count to each).

Corona: 1, absent, 2, diffuse, 3, regular, near margin; 4, double, with both diffuse and regular portions.

Clavus: present or absent. The clavus may possibly have been overlooked in a few forms where the sacculus is overdeveloped. A weak spine-tuft in the position of the clavus was not counted, unless it formed a definite separate organ.

Clasper: absent, simple and longitudinal, simple and more or less transverse, and forked, were each counted as one degree apart from each other, and intermediate stages were given half-counts. Note that the dorsal arm of the so-called forked clasper is morphologically the ampulla, and that the ventral arm, or true clasper, migrates to the lower edge of the valve, and then out, becoming the pollex. This structure was counted as a rudimentary lower arm of a forked clasper in *Ochropleura*, but was treated as a separate organ in such forms as *Noctua (Graphiphora)* even when the chitinization supporting it was still preserved.

Costal chitinization: a specialized chitinization ending abruptly at the base of the clasper was made one count different from a simple costa; a vague chitinization without definite end was given half a count.

Costal process: a definite specialization of the costal edge got one count, a mere bend was not counted.

Pollex: present or absent. See note on clasper.

Digitus: present or absent.

Sacculus: a specialized process attached to the sacculus was given one count; a mere enlarged sacculus got half a count only when strikingly developed. The curious asymmetrical structure of *Protexarnis* was also given a half-count.

Hadenid neck: an abrupt narrowing of the valve beyond the clasper, suggesting the form of "*Hadena*" or "*Mamestra*." One count.

Ædoeagus: unarmed, with one spine, multiple spines, two spines or scobinate patch were each given one count from each other. A rudimentary spine, as in many Euxoas, got

half a count. A scobinate patch was not counted in presence of a well developed spine.

Juxta: simple, with terminal spine, or with a square process were given one count from each other; the rounded process of *Noctua* (*Graphiphora*) was counted as half a square process. An attempt was made to tabulate the shape of the juxta but it was often too indefinite to handle.

Several other characters might have been used. The palpus shows some marked differences of type, but they were too ill-defined to be readily tabulated, and the most striking of them (the presence of long hair) correlated with the hairy thorax and merely reënforced that character. My material was not all good enough to be sure of the shape of the abdomen, which is probably a significant character, especially in subdividing the third group. Characters limited to a single genus were not tabulated, and so the relationship shown by the table should often be taken to represent not the genus as it is, but its presumable ancestor lacking its present *unique* specializations. This applies for instance to the pyramidal thoracic tuft and fore tarsal spines of *Richia*, the fantastic front of *Proragrotis*, and the uncus of *Lampra*. Such characters may perhaps be important for delimiting a genus, but give no light on the interrelationships. In general, I believe they are modern, and may even fail when other species of the genus are studied.

The chart will present the resulting relationships. Each square represents the relation between the genus named at the end of its line, and the one at the end of its column. *E.g.*, the solid black square where the fifth line and third column meet indicates that the genera *Onychagrotis* and *Mesembreuxoa* differ by not more than three characters. The arrangement is such that genera which come next to each other in order will have their correlations shown near the diagonal margin of the chart, the actual last row of squares representing the relations between successive genera. I have used dark symbols for small differences and pale ones for large differences, so that a glance will show from the massing of dark areas toward the diagonal, that the arrangement is not too far from correct.

The three large groups and two small ones are separated by heavy lines, and the largest is divided into two subgroups, marked by a broken line. The arrangement may be considered almost strictly linear within each group (or subgroup) but the aberrant genera have been placed at the ends of the groups, so that the correlations between the terminal members of adjacent groups are not high.

One may also pick out the types that are synthetic in character by running along the lines, and seeing where there is an unusually high per cent of dark symbols. For instance, if we run along the lines, we find *Naenia* and *Cryptocala* show a massing of the solid black and the small white squares; they therefore differ by six characters or less from an unusually large number of genera in the third group, and so may be considered to represent the central forms of that group. On the other hand we find that *Protexarnis* has very few such symbols, and these few widely scattered; it therefore is an isolated form,—perhaps a primitive relict, that has gone off sideways. The heavy mass of dark in the group III indicates that a large number of the nominal genera here are very closely related, while the more scattered pattern in group II indicate a less homogeneous lot, that are no doubt older, for it is very generally believed that large numbers of groups with few species per group are a sign of age and partial extinction.

If we take a difference of not more than six characters as being generally allowable within a genus, we will be led to admit approximately the following genera:

In group I, *Chorizagrotis* through to *Trichosilia* are obviously very closely related, and may be fairly rated as subgenera, but *Eucoptocnemis* and *Manruta* obviously stand out from all the preceding and somewhat from each other, and should no doubt be kept as good genera, or combined with *Tripseuxoa* and each other.

In group II, *Pareuxoa lineifera* stands entirely by itself. It certainly has little or nothing to do with true *Euxoa*, which is a homogeneous enough type, and so I am giving it a distinctive generic name. *Stenagrotis*, which is unknown to me, may be related. There is no obvious reason for making a smaller or larger number of genera out of the remainder. *Ochropleura* is central and shows close links to all, even to the preceding and following groups, but the rudimentary lower fork of the clasper is most nearly matched in *Protogygia*. *Euagrotis* is very close to *Anicla*, and both are connected closely to *Hemieuxoa* by South American species discussed in the appendix. *Hemieuxoa*, *Peridroma* and *Diarsia* make another group, marked, for instance, by the Hadenid neck and more normally forked clasper. *Pseudorthosia*, *Richia*, *Pseudoglaea* and *Mesogona* have the best claim for generic status.

The group as a whole is interesting in distribution, having a most primitive South American group, with *Peridroma*, *Hemieuxoa* and *Anicla*; the holartic *Diarsia*, perhaps a little more at home in Europe than North America, the wide-spread *Ochropleura*, palae-

arctic *Mesogona*, and endemic North American *Richia* and *Pseudoglaea*. *P. margaritosa*, perhaps the most primitive of all, is now world-wide, though possibly most at home in South America, as the Chilean segregate, *P. semifusca*, would hint.

While group II is heterogeneous, and the difficulty is to decide what groups to combine, group III is extremely homogeneous, and the trouble is where to make a cleavage at all; in fact, except for a few aberrant types there is a temptation to leave groups III and IV undivided. *Protexarnis* may be set aside at the start, it really deserves a group to itself, and shows several primitive characters more normal in group II, such as the digitus, double clasper and bearded uncus; it is certainly a relict. *Ammoconia* is also a little aberrant, but the rest can at most be divided into two lots, with a good deal of embarrassment in drawing the boundary. I have drawn the chart on the assumption that *Lycophotia* to *Hiptelia* make one genus, and *Pseudoseptis* to *Setagrotis* another, but the two are massively connected, and even group IV joins on through *Pachnobia* and *Hiptelia*. Traditionally this series is cleaved by the presence or absence of spines on the fore tibia, but *Noctua baja* gives warning of the danger, as it is intermediate alike in tibial spining, appearance, and even in caterpillar. For the caterpillar resembles *Rhynchagrotis barnesi* even in habits, being a notorious climbing cutworm; and other species of *Noctua* also are identical with *Rhynchagrotis* even in markings.

The yellow-winged European genera all come in this group (except *Cyrebia*, which is not a true Agrotid), but they are not at all close to each other, *Triphaena* (*promuba*) going definitely with *Noctua*, while the other three group loosely about *Rhynchagrotis*. I believe the cause for these yellow Trifidae must be sought in some special past ecological factor in the Palearctic zone, and not a common origin. The fact that they are limited to the Old World, except for a few modern stragglers, is curious.

Group IV is plainly homogeneous, and hardly needs more than a single genus; in fact we might add *Hiptelia* and *Pachnobia* and reconstitute the old genus *Pachnobia* of Smith *et al.*, with very little violence. *Choephora* definitely belongs in this series, as Hampson has already placed it; but typical *Epipsilia* (*latens* and *grisescens*) stands apart, and Hampson's name cannot be used.

*Trichosilia* has already been placed in group I, where it makes just about a good subgenus, and the hairy-eyed *Pachnobias* are certainly not to be separated from *okakensis*; but I believe the remainder are not true Agrotines. The four genera with dense hair



(*Trichorthosia*, *Mimobarathra*, *Trichofeltia* and *Trichagrotis*) have some very distinctive characters, which reappear in the *Poliinae*, and no doubt that is where they belong. I believe now that *Trichorthosia* and *Trichagrotis* are mere variants of *Eriopyga*, to which their pattern also connects them, but *Mimobarathra* comes closer to *Barathra* itself, and *Trichofeltia* has no immediately obvious connection. Perhaps a fuller study of the hairy-eyed series will put these genera in their proper places. The male of *Trichagrotis* is of course unknown, but the female only differs in the spining of the fore tibia from *Trichorthosia*, and the pattern is identical. McDunnough's figure of *Trichorthosia* is incomplete; in fact the form has a triangular sacculus and exaggerated Hadenid neck, its genitalia being of a perfectly normal "Poliine" type (fig. 10).

The *Anytus* group are also wholly outside the *Agrotine* series, and will no doubt take their place when the "Acronyctinae" are analyzed. *Anytus* and *Fishia* certainly have something in common; *Cyrebis* has the *socii* of *Anytus* exaggerated, but *Ufeus* will probably attach to another group of *Acronyctinae*.

The generic list then may run somewhat as follows:

#### GROUP I

*Agrotis* (with *Chorizagrotis*, *Euxoa*, *Mesembreuxoa*, *Feltia*, *Onychagrotis*, *Proragrotis*, *Loragrotis* and perhaps *Trichosilia*)  
*Eucoptocnemis* (with *Tripseuxoa* and *Manruta*)

#### GROUP II

*Pareuxoa* ("Euxoa" *lineifera*)  
*Pseudorthosia*  
*Richia*  
*Pseudoglaea*  
*Ochropleura* (with *Protogygia*?)  
*Mesogona*  
*Anicla* (with *Euagrotis*)  
*Peridroma* (with *Hemieuxoa* and *Diarsia*)

#### GROUP III

*Protexarnis*  
*Noctua* (with *Lycophotia*, *Heptagrotis*, *Eugraphe*, *Caradrina*, *Chersotis*, *Epipsilia*, *Triphaena*, *Graphiphora*, *Pachnobia* and *Hiptelia*)  
*Ammoconia*  
*Eurois* (with *Pseudoseptis*, *Actebia*, *Naenia*, *Anaplectoides*, *Hemigraphiphora*, *Eueretagrotis*, *Anomogyna*, *Spaelotis*, *Aplectoides*, *Lampra*, *Euschesis*, *Pronoctua*, *Rhynchagrotis*,

*Cryptocala, Abagrotis, Protolampra, Adelphagrotis, Pseudospaelotis* and *Setagrotis*)

GROUP IV

*Cerastis* (with *Metalepsis, Sora, Choephora, Paradiarsia* and *Hemipachnobia*)

GROUP V (not Agrotine)

*Trichorthosia* (with *Trichagrotis*?)

*Mimobarathra*

*Trichofeltia*

GROUP VI (not Agrotine)

*Anytus, Fishia, Ufeus, Cyrebia*, etc.

In the following definitions of the groups, the word "usually" must be taken as applied to every character, as no one character seems stable in any case, unless the presence of dense hair on the eyes in group V.

Group I: Front modified, antennae subserrate and fasciculate to pectinate, vestiture mixed, fore tibia with strong spines or terminal claws, mid and hind tarsi with upper spines; valve with normal corona, clasper longitudinal (or a little oblique) or forked; costa normally thickened, the thickening ending abruptly at the clasper, but not irregular in shape; juxta unarmed, uncus heavily bearded and clavus often present. Larva so far as known rough-skinned.

The chief exceptions are: front smooth in *Eucoptocnemis*, which has the strongest tibial claws of all; antenna most nearly simple in *Chorizagrotis, Loxagrotis* and *Proragrotis*; vestiture hairy in *Manruta* and a few *Euxoas* (*bostoniensis*); costal chitinization absent in *Proragrotis* and *Eucoptocnemis*, and weak in a few others; uncus not tufted in *Proragrotis* and weakly in *Loxagrotis* and *Manruta*.

Group II: Front smooth; antenna subserrate and fasciculate, or usually simple, vestiture mixed, fore tibia with moderate spining, hind tarsus without upper spines; genitalia with corona present, clasper usually longitudinal or divided, juxta frequently with a spine; uncus normally tufted and clavus normally present; digitus often present; hadenid neck frequent.

The chief exceptions are: front very rough and prominent in *Pseudorthosia*, with raised ring in *Pareuxoa*, rough in *Mesogona* and *Protogygia*; antenna almost pectinate in *Pareuxoa*; vestiture hairy in *Pseudorthosia* and *Pseudoglaea* and mostly hairy in a few others; hind tarsus with upper spines in *Richia* and *Pseudorthosia*, but fore tibia un-

armed in *Pseudoglaea*; corona absent in *Pseudorthosia* and *Pareuxoa*.

Group III: Front smooth, antenna simple or fasciculate; vestiture mixed; fore tibial and hind tarsal spining variable; corona rudimentary or absent; lower fork of clasper frequently developed as a pollex, never normally developed; Sacculus more or less inflated, frequently modified more or less uncus with rudimentary tufting or none.

The chief exceptions are front a little rough in *Cara-drina*, antenna pectinate in *Hiptelia*, some species of *Noctua*, *Anomogyna*, etc., vestiture hairy in *Pachnobia* and nearly so in *Hiptelia*; a diffuse corona in *Noctua* and *Ammoconia*, tuft on uncus strong in *Ammoconia*, *Actebia*, and a few of the last subgenera, also apparently in *Aplectoides*; clavus present in *Eurois* only.

Group IV: Eyes always lashed, though often feebly; front smooth; antenna serrate or pectinate, weakly only in *Cerastis*; vestiture wholly or almost wholly of hair, often with a few flattened hairs and rarely with scattered spatulate hairs; corona absent; clasper longitudinal or oblique, rarely very weak; juxta often with a spine; tuft on uncus weak or absent, and spines on fore tibia never strong, often absent; clavus absent.

Group V: Eyes strongly hairy and more or less lashed; front smooth, antenna subserrate to pectinate; fore tibia with rudimentary spines or none, and hind tarsus without upper spines; corona present, sometimes rudimentary, digitus present, heavily chitinized, and associated at base with clasper (perhaps a homologue of the true clasper rather than a real digitus); penis with numerous separate spines.

If we ignore the numerous exceptions we may key the groups as follows:

1. Eyes strongly hairy, digitus associated with clasper; penis with numerous spines .....Group V  
    Eyes naked or with rudimentary hair, digitus well separated when present; penis with a single spine or scobinate patch...2
2. Corona normal, uncus tufted, clavus present .....3  
    Corona absent, uncus with scattered hair, clavus absent .....4
3. Front rough or modified, antenna serrate or pectinate, fore tibia with strong armature; hind tarsus with upper spines.  
    Group I  
    Front smooth, antenna simple, fore tibia weakly spined and hind tarsus without upper spines .....Group II
4. Vestiture hairy, antenna pectinated .....Group IV  
    Vestiture mixed, antenna simple .....Group III

## REMARKS ON CERTAIN GENERA AND SPECIES

*Chorizagrotis*. This genus has no really significant difference from *Euxoa*, even the clasper differing only in proportions, not at all in type. *Protexarnis balinitis*, which Smith put in *Chorizagrotis*, and McDunnough put immediately after, is really highly aberrant. Its digitus points to group II, the inflated sacculus more definitely to group III, of which it is perhaps an aberrant member.

*Mesembreuxoa*. Practically a synonym of *Agrotis*. A well-marked group of Agrotini in South America, apparently distinct in origin from the primitive forms in group II. The transverse ridge on the front, used by Hampson to define the genus is meaningless, like the vertical ridge which he reports for *Feltia*.

*Loxagrotis* seems the most generalized member of group I. There would seem to be a real connection with *Protogygia* of group II and to the South American *Hemieuxoas*. This is the main part of the genus which Smith called *Rhizagrotis*.

*Trichosilia* is hardly distinct from *Loxagrotis*. The hair on the eyes is weak, and similar to that in *Pachnobia*.

*Eucoptocnemis* seems as isolated on full study as it has always been. The smooth front is unique in the *Agrotis* series, to which the genitalic characters attach it safely. The fossorial tibia is only matched in the Heliothids, but other characters are entirely different, and I think it is merely a case of parallelism. The only relatives of *Eucoptocnemis* are *Manruta*, which has the same fossorial tibia and weak tongue, and looks a little like *Eucoptocnemis*, but differs clearly enough in the rough front, hairy vestiture, obsolescent corona, etc., and the South American *Tripseuxoa*, which is intermediate, but side-specialized.

*Pareuxoa lineifera* has nothing in common with the real species of *Euxoa*, and no doubt its fossorial fore leg and modified front are a parallel adaptation for emergence from sun-baked desert soil, such as occurs in many other groups. Leaving these out of account, the affinities are plainly with group II, but there is a beautiful composite of primitive and side-specialized characters. I believe it represents a group that arrived early in South America before the two big modern groups of Agrotini were formed, and has survived and multiplied there. Temperate South America has a number of aberrant forms which may be related, including one or two transitional to *Hemieuxoa*.

*Pseudorthosia*, *Richia* and *Pseudoglaea* are plainly synthetic forms; *Richia* lies almost exactly intermediate between groups I and II, and the main reason for putting it in group II is the greater



heterogeneity of that group, which receives an aberrant form with less disturbance; *Pseudorthosia* also tends to link with groups III and IV, and is an offshoot from far down in the evolution of the tribe; the superficial special likeness of *Pseudoglaea* to *Mesogona* is hardly carried out in more important characters. My belief is that McDunnough has these genera badly misplaced, especially *Pseudoglaea*, whose genitalic characters are utterly unlike those of the *Rhynchagrotis* series. The numerous spines on the penis, however, are shared by *Eueretagrotis* alone.

*Ochropleura*. The peculiar rudimentary spine on the lower margin of the valve gives the clew to the pollex, as it is clearly homologous with both the lower lobe of the clasper of *Euxoa* or *Hemieuxoa*, and with the pollex of *Noctua* (*Graphiphora*). *Protogygia* also shows the same stage of development, and there is something like it in *Pseudospaelotis*, while *Euagrotis* has preserved the supporting chitinization without the free point. In this series McDunnough has an entirely different grouping, interlarding *Actebia*, *Spaelotis* and *Eurois* from my group III, and even the American members of group IV. Of these *Eurois* and *Actebia* seem really to lean to group II, but I cannot see the connection of *Metalepsis* and *Cerastis*, *Hemipachnobia* and *Paradiarsia* at all. *Ochropleura* is a peculiarly synthetic type, as the large number of close resemblances to other genera (small white squares in the table) will show, and is curiously distributed, with endemic species both in Europe and South America.

*Peridroma margaritosa* has the distinction of having more primitive characters or characters shared with the presumably ancestral Acronyctinae than any other species of the group (unless the South American *Hemieuxoa polymorpha*); in fact there is not a single character that I can definitely label specialized. The shape of the apex of the valve and the position of the digitus are specially Acronyctine characters. *A priori* it would be an open question whether the diffuse weak spining on the tibiae, as in *Peridroma*, or the unarmed fore tibia of *Rhynchagrotis*, etc., were primitive, but I think the fact that *Peridroma* is an isolated type, in a group largely of odd forms, while *Rhynchagrotis* is typical of a large and dominant modern group, is pretty conclusive.

*Protexarnis* (*Chorizagrotis balinitis*) is put by McDunnough immediately next to *Chorizagrotis*. The form of the clasper is the same, but every other character points to a wide separation from *Chorizagrotis*; in particular the digitus indicates a much more primitive form. The position at the head of group III is rather

arbitrary, but it shares more characters with members of this group than any other; its affinities are widely scattered, and presumably it represents a side-specialization from the ancestor of the group. The digitus has otherwise disappeared from group III (except for a rudiment in *Ammoconia*) but its presence in *Metalepsis*, which derives from group III, is a further indication that the group originally had it.

*Group III.* The order of genera in group III is more arbitrary than elsewhere in the list, and would be changed by small changes in weighting of characters. The whole group are extremely closely related, and could well be left a single genus, but the separation into a *Graphiphora* series and a *Rhynchagrotis* series appears to be natural. Some links are obvious, as between *Caradrina*, *Chersotis* and *Epipsilia*, but others may be parallelism, as between *Lycophotia* and *Heptagrotis*, in fact the peculiar type of valve would connect *Lycophotia* with *Epipsilia*.

*Eugraphe* is unusual, in having upper spines on the mid-metatarsus only.

*Eurois* shows some resemblance to groups I and II, especially in having a well developed clavus; it may be ancestral.

*Actebia* has the spining of the tibia stronger than usual, and suggests a connection with *Agrotis*. It has a normally smooth caterpillar, unlike group I.

*Lampra fimbria* has an unique reduced and malformed, trilobed uncus; otherwise it agrees with *Noctua* (*Graphiphora*). The caterpillar is the wedge-marked type of this group rather than the striped type usual in group II, but does not discriminate between the subgroups. *Lampra* has the spined fore tibia of *Noctua*, while *Triphaena* shows the unarmed tibia of *Rhynchagrotis*; they also differ in genitalia, *Triphaena* having the curious thin transverse clasper normal in the *Rhynchagrotis* series.

*Pachnobia* and *Hiptelia*, which is certainly very close (not Orthosid), could nearly as well, perhaps better be put in the fourth group, but *Pachnobia* seems directly connected with *Noctua* also. *Chersotis*, which contains species which have also much in common, seems to have gone off in another direction, in the extreme development of the sacculus. *Chersotis* also has lashes on the scape of the antenna (not true lashes on the front) and an unique spine on the penis.

*Noctua* (*Graphiphora*) has a curious development of the juxta, differing from species to species. In *c-nigrum* it is scobinate, while in *N. (Lytaea) umbrosa* it has a double spine. The caterpillars of

this genus are well known for their paired blackish subdorsal patches, but really this pattern tends to appear in any part of group III, and is striking, e.g., in *Triphaena*, *Lampra*, *Rhynchagrotis*, *Spaelotis*; group II tends rather to be striped.

*Naenia*. This is the genus which strict constructionists would make *Noctua*, or even *Phalaena*, as it contains the species named *typica* by Linnaeus. While a little exaggerated in appearance it is really very close to *triangulum*, the traditional type, so that the change would not be very violent after all. The most striking difference is the heavy tufting, but larva as well as genitalia place it in this group. It seems very close to *Anaplectoides (pressa)*.

Group IV. *Paradiarsia* and *Hemipachnobia* go together, and stand a little apart from the rest, but hardly make what would normally be called a distinct genus. If a character is wanted to separate them the presence of upper spines on the hind metatarsus will serve. *Sora* has an unique bundle of long spines in the penis, and *Cerastis* a spinose gnathos, which are unique in the tribe, but probably hardly more than specific in significance.

Group V. *Mimobarathra*. The appearance and heavy tufting suggest *Barathra*. The uncus is obsolete, fore tibial epiphysis modified and tarsus spined. The type of digitus is much more to be expected in the hairy eyed series, and the multiple spining on the penis is very rare in the Agrotini.

*Trichorthosia*. McDunnough's figure is incomplete (see fig. 10). The form has a widened tip of the valve with Hadenid neck and corona, and the whole thing indicates close affinity to *Eriopyga*, where the pattern is absolutely normal.

*Trichagrotis*. The female shows no very important differences from the preceding, and the markings are almost identical. I suspect the slightly stronger spining is not of generic value.

*Trichofeltia*. It is one of the mysteries how this type ever came to be confused with *Feltia*, with which it has practically nothing in common. The genitalia suggest *Trichorthosia*, but are much more specialized, and no doubt it will find its place when the hairy-eyed groups are properly studied.

#### PHYLOGENY

An attempt was made to select the most probable ancestor of the group by making out a list of characters that were either obviously primitive, or common to some Agrotini and many Acronyctinae. Where there was doubt an intermediate condition was chosen. When this list was compared with the characters of

the various genera it was found that *Peridroma saucia* came far nearer than any other genus, and that group II as a whole was nearer than any other group. This suggestion that group II is ancestral is confirmed by the fact it is more heterogeneous than the others, and that it has a large percent of isolated species. Evolution within the group may be indicated by the survival of the various ancestral characters of *Peridroma* in other subgenera and genera.

*Hemieuxoa* and *Diarsia* are obviously immediate derivatives of *Peridroma*. At the next level comes *Ochropleura*, which is apparently on another line, and from which *Protogygia* may be directly derived; *Euagrotis* and *Anicla* make another line; perhaps associated with the first. This little genealogy is perhaps as plausible as any (fig. 11).

Group I is obviously derivable from group II, and the ancestor might be something much like *Protogygia*, but with better developed clasper, more like *Peridroma* itself or *Hemieuxoa*; from this there must have arisen two main branches, one which kept the forked clasper, and the other which lost the lower branch. From some member of the latter (most probably *Onychagrotis*) arose *Manruta* and *Eucoptocnemis*, which have a good deal in common but have diverged in the front and many details. Presumably the Heliiothidini, which have also the rough front and granulose caterpillar, come from the stock of group I, and it is possible that *Manruta* may represent the line of connection, though I believe that the Heliiothidini arose from near typical *Agrotis*. *Heliiothis* lacks the clasper, but it is perfectly well formed in *Rhodophora*.

Group III is on the whole so homogeneous that phylogeny has little meaning. *Actebia*, *Naenia*, *Pseudospaelotis* and *Setagrotis* on the whole resemble *Peridroma* in the most characters, and are no doubt primitive in their subgroups; *Anaplectoides* is also low, and shows resemblances to the widest range of genera. The mass of subgenera may be divided into a group that tend to strengthen the leg-spining and to develop a row of spines on the metatarsi (*Eurois*, etc.) and one that tend to weaken the spining and finally lose it wholly from the fore-tibia (*Rhynchagrotis*, etc.). *Lampra* is curious in combining both tendencies, and is uniquely specialized besides, but must have some connection with *Noctua*, while the other yellow-winged genera belong to the *Rhynchagrotis* group, where each is specialized in a different way. *Pachnobia* and *Hiptelia* are directly derived from something like *Noctua*, and in turn supply the point of origin of group IV.



Group IV seems to be composed of two main subgroups, one with *Paradiarsia* and *Hemipachnobia*, the other with *Sora* and *Cerastis* as relatively primitive members, from which *Metalepsis* and *Choephora* are separately derived.

#### SUMMARY

The Agrotini as restricted by McDunnough may be divided into four main subgroups:

a. *Agrotis*, etc., with corona, modified front, antenna and fore legs; and rough caterpillar.

b. *Peridroma*, etc., with corona, smooth head, frequently modified genitalia and smooth generally striped caterpillar.

c. *Noctua*, etc., without corona or special body-modifications, but with a tendency to reduction; caterpillar smooth with subdorsal spots as a rule.

d. *Cerastis*, derived from c, but with hairy vestiture.

2. The second group is primitive, *Peridroma saucia* being the most primitive species; the dominant 1st and 3rd groups are separately derived from it.

3. *Cyrebia*, *Trichofeltia*, *Mimobarathra*, *Trichorthosia* and probably *Trichagrotis* are not Agrotini, besides the genera rejected by McDunnough. *Manruta* is Agrotid.

#### SUPPLEMENT ON SOME SOUTH AMERICAN TYPES, INCLUDING NEW NAMES

It has been assumed in the preceding that McDunnough's revision supplies most of the information necessary for the discussion of the North American forms, which have been supplemented by figures of a few European types not figured by Pierce. In the case of the South American fauna nothing has been published on their genitalia and little on their classification otherwise, so a little more detailed information is in order. The following notes include only perhaps half of the known South American Agrotids, but are sufficient to give a clear picture of the general character of the fauna. A large proportion of the remainder are represented only by specimens in the British Museum. They have not been studied with care, but their general appearance suggests that they will fall into the same groups, though they may add some further variety of structure. The most striking feature is that the third group, dominant in the northern hemisphere, seems entirely unknown from

South America, and the fourth group, which is a segregate of it, is also absent.

Generic terms are used in a more inclusive sense than by McDunnough, treating McDunnough's genera as subgenera, as discussed above.

#### AGROTIS Ochsenheimer

(type *Phalaena segetum* Schiff.)

Antennae varying from nearly simple to pectinate, most typically heavily serrate and fasciculate. Front rough and rounded out, except in the North Temperate race of *A. ypsilon*, and *A. geniculata*; frequently with a raised ring, which may contain unstable traces of further structures. Tongue strong. Fore tibia with heavy specialized spines supplemented with spines on the tarsus in *A. orestica*, new species; mid and hind tarsi with upper spines; uncus heavily bearded, normal; valve with corona and simple curved clasper, without digitus or pollex, or costal or dorsal modifications; clavus variable in size, sometimes minute, but never absent. Penis unarmed or with a simple small scobinate patch or a minute spine.

In this conception I include *Feltia* and *Mesembreuxoa*, of the genera reported from the South American fauna, the frontal ridges which Hampson uses for their differentiation being inconstant accidents of development of the area within the chitinized ring. Of the genera not yet known from South America, *Loragrotis*, *Onychagrotis*, *Porosagrotis* and *Proragrotis* are very close and should probably be included; *Euxoa* with *Chorizagrotis* differs in the more complete forked clasper, but is really hardly distinct. The most convenient subdivision<sup>3</sup> is by the male antenna, which varies from plumose (*fascicola*) to nearly simple (*orestica*); small differences in the genitalia, such as the armature of the penis, may be really more important, but the group is genitally very uniform. Only *A. orestica*, new species, is more aberrant in lacking the corona and having enlarged spines on the fore tarsus. It has the minute single cornutus of typical *Feltia*.

<sup>3</sup> A tabulation of the species indicates that the strength of the clasper is perhaps a more important character to divide *Agrotis*. In *A. annexa*, *bilitura* and *fascicola*, as well as the North American *herelis* group it is strong, while in *malefida* and *experta*, with the North American *venerabilis*, *vetusta* and *volubilis*, the wide-spread *ypsilon* and the European *segetum*, it is much weaker. *A. edmondsi* shows a very weak clasper, thus differing from *fascicola*, while *orestica* has an exceptionally strong one.

\**Antenna pectinate*

*A. fascicola* Dyar. My specimen is compared with the type, and seems to differ only in the much better condition. It is much like *M. chilensis* but much larger. The vertical ridge on the front fails as a character, and these two species will run in Hampson's keys to *lutescens* and *araucaria*, from which they differ by the strongly developed black wedges before the s. t. line. *A. edmondsi* is really closer, but has contrasting pale veins (not white but light clay color). Male genitalia (fig. 1) with clasper larger in proportion to the valve than in the majority of species, and clavus minute. No cornuti.

*A. edmondsii* Butl. Closely similar to the last in pattern, except that the veins are broadly streaked with cream or clay color. Antenna hardly as broad, but broader than in *ypsilon*. Genitalia with short clasper (fig. 2), slenderer valve than usual and obsolete clavus. Penis with a small scobinate patch as in *A. segetum*, *experta*, etc.

*A. edmondsii* Butl. Closely similar to the last in pattern, except in all its forms by the small black wedge at the outer side of the reniform. Otherwise some specimens may show a remarkable resemblance to *annexa*, even with traces of its sexual dimorphism. Chilean specimens (*A. y. robusta* Blanch.) are very large and pale and have a strongly roughened and rounded front, while northern specimens, unlike most species of *Agrotis*, are smooth. The form from Lima, Perú, is normal in pattern and coloring, but shows traces of the rough front. Male genitalia similar in Europe, North America and Chile; figured by Pierce, Genitalia of British Noctuidae, Pl. 16, under the name of *suffusa*. Clavus small but distinct, clasper small, as in *edmondsii*; penis with scobinate patch.

Hampson puts *A. araucaria*, *coquimbensis* and *americana* in this group. None of these are at hand.

\*\**Antennae strongly serrate and fasciculate*

*A. annexa* Treit. The antennal serrations in this species are very strong, and the female is strikingly darker than the male; the relationship with *ypsilon* is certainly close. My specimens from Lima vary widely. The largest agrees with my notes on *lutescens* in the B. M., being large, with a heavy blackish shade below the base of the cell, and another from the end of the cell to the st. line. A small specimen (fig. 15) on the other hand has no traces of the two shades but only a slight basal dash and a very slender bar be-

tween the orbicular and reniform, which are small but strikingly outlined with black. Others are intermediate and much like North American males. The female associated with *lutescens* in the B. M. is much paler than others and not much darker than the male.<sup>4</sup> Male genitalia (fig. 14) with medium sized clasper, a little larger in proportion in the pauperized specimen (fig. 15), apex of valve a little extended costally but less than in *malefida*, strong slender clavus and unarmed penis.<sup>5</sup>

*A. malefida* Guen. This is one of the few *Agrotis* that are found in the Brazilian subregion, but apparently is less at home there than *margaritosa* and especially *infecta*. My male from Lima is paler and more crisply marked than normal ones and the females are much darker with obsolescent markings. The male resembles *A. canities*, but differs in having distinct subterminal black dashes between the veins, and (perhaps not always) in the solid black claviform. The female is hardly distinguishable from the blackish female of *experta*, which is common also at Lima, but *malefida* can generally be separated by the t. a. line, which loops out more than half way to the t. p. below vein A. The genitalia of *A. malefida* (fig. 17) seem indistinguishable from *experta*.

*A. experta* Wlk. This is the common *Agrotis* at Lima, my specimens being taken at street lights in the city at the beginning of the rainy (or rather misty) season; May 15–21, 1920. The type were from Callao, only 7 miles away. This species is distinguished latter extremely variable in form, from a small circle to a long by its plainness; the ren. and orb. usually dark smudges, but the fusiform shape connecting with the ren. Specimens of both show the same genitalia. It agrees with *malefida* in genitalia, and in most pattern features, except for the vagueness of all markings, and with the local strain of *malefida* also in the sexual dimorphism, the female being blackish and the male light ash gray. It differs in the t. a. line, which is not strongly waved and not specially extended

<sup>4</sup> Note that by some accident Hampson entered *lutescens* twice, as an independent species of *Euxoa*, and as a synonym of *annexa*.

<sup>5</sup> Just here there is some tendency to preserve the digitus, as in the North American genus *Richia*, which may be related. In one specimen of *annexa* from Lima agreeing with form *lutescens*, there is a distinct trace as a chitinized prominence; another pauperized specimen does not show a trace. In a North American specimen there is a just traceable rudiment, while in a closely related, but apparently undescribed species from the Argentine the digitus is well formed (fig. 16).



below the cell. The genitalia (fig. 5) are as in *malefida*, with the apex strongly extended costally, moderate clasper, and small scobinate patch on the penis,

*A. canities* Hamp. (Grote ms.) was examined superficially at the British Museum. It differs from both these species in having no trace of subterminal black dashes, otherwise it might be a form of either, showing the general lack of contrasts of *experta*, with the course of the t. a. line of *malefida*. The ren. was round, but the Lima series of *experta* throws suspicion on this character.

*A. bilitura* Guen. This species shows remarkably little really describable to separate it from *annexa*. The antenna is perhaps a little less serrate, the moth larger and heavier, not sexually dimorphic, but with identical markings. The best difference is perhaps the terminal area, which is luteous in *annexa* (concolorous with the lower median area in the male, but contrasting in the female) while in *bilitura* it is concolorous fuscous in both sexes. My specimens are from Lima, Perú, the types were from Chile. The male genitalia (fig. 6) have broader and more massive valves than the other species; clasper medium, clavus very strong and penis unarmed. "*Euxoa*" *hispidula* Guen. was not examined, it must be very close.

\*\*\**Antennae simple, fasciculate*

**A. orestica** new species. Male antennae simple, but heavily bifasciculate; front rough and rounded out, with a diffuse ring; eyes naked, with rudimentary lashes; thorax with mixed vestiture, largely spatulate, with rather divided tufts; palpus with second segment widened to end, but not really clavate. Fore tibia with moderate spines, mid and hind tarsi with subdorsal series of spines; tarsal spines as a whole rather stronger than usual, especially on outer side of fore metatarsus. Male genitalia (fig. 20) with outer part of valve aborted, without corona, clasper large and simple, longitudinal, costa with abrupt end to thickening, no special modifications; uncus broad and heavily bearded; juxta simple, clavus very large; penis with heavily chitinized margin and both a minute spine and diffuse scobinate patch.

Dull fuscous. Head blackish, with lower face fuscous; palpi blackish, with luteous hair-scales on lower edge and tip of second segment, and luteous inner face; antenna with contrasting cream scape; shaft above annulate with luteous and blackish, the base nearly solid blackish, and outer part becoming mainly luteous. Thorax with basal half of collar black, contrasting, the rest frosted with fine white scale-

tips. Abdomen lighter, and with a little warmer yellowish or buffy tint above. Fore wing mostly vaguely shaded, costa paler down to below cell toward base, defined below by a diffuse but contrasting black basal dash; subapically also blackish, ending abruptly at the position of the st. line; a faint darker t. shading opposite cell. B. l. a conspicuous double blackish stria at costal edge, and showing again as a contrasting luteous oblique bar across the basal dash; t. a. also showing as a double costal stria and oblique bar across tip of basal dash; the basal line oblique in, the t. a. oblique out. T. a. also faintly traceable the rest of the way, waved, and extended out below A. Claviform obsolete; orb. a pale V, open widely to costa; ren. a vague pale shade, a little more defined on its inner side; t. p. and st. pale, defined with dark, only visible in a favorable light; the t. p. excurved moderately, most strongly over  $M_2$  and  $M_3$ ; abruptly offset far in at costa, on lower half of wing lunulate, with two lunules in fold; st. extended half way to margin opposite cell, dentate below. A fine faint broken blackish t. line. Fringe with three paler and darker fuscous stripes, the extreme base palest. Hind wing translucent white, with a little infuscation on margin, on veins toward margin, and especially on the long hair at inner margin. Expanse 40 mm.

Matucana, Perú, on west slope of the Andes; June 16, 1914. H. S. Parish; type male in Cornell University collection and one paratype, type no. 1242.

This species may go in the subgenus *Porosagrotis* but is distinguished by the loss of the corona. I do not know any other species that belongs with it; they may be found in Hampson's last group of *Euxoa* (e.g., *cleiducha*) or *Feltia* (*clerica*).

#### EUXOA Hübner (*Carneades* Grote)

(type *nivens* Hübner)

Similar to *Agrotis*. Clasper deeply bifurcate.

I have no authentic record of the occurrence of this genus (in the sense of Grote, Smith, McDunnough and North American workers generally) in South America, though I have a single female from Oroya, Perú, that appears to belong to it. Most of the Hampson species examined belong to typical *Agrotis*,—in fact, he even includes *segetum*, the type of *Agrotis*, in *Euxoa*. *E. lineifera* is a very distinct type, and does not even belong to this group. Several species have not been examined for genitalic characters, and where not very close to known species cannot therefore be placed.

## TRIPSEUXOA Hampson

(type *T. strigata* Hampson)

Showing the principal characters of group I. Tongue weak, front rough and rounded out; eyes naked with rudimentary lashes; antenna pectinate; vestiture fine but mixed with hair and flattened hair; tarsi without upper spines, fore tibiae spined. Thorax smooth. Male genitalia (fig. 21) without corona, clasper simple, oblique; no other modifications. Uncus bearded (modified). The genus is distinct enough to be kept separate from *Agrotis*, but could be legitimately treated as a subgenus of the North American *Eucoptocnemis*, with *Manruta*. The differences are numerous but not important, the chief being the weaker spining of the fore tibia as reported by Hampson (lost in my species) and loss of the corona. The latter character is paralleled by the preceding species of *Agrotis*, and in both cases accompanies a reduction of the whole end of the valve (unlike the *Noctua* group). *Eucoptocnemis* and *Manruta* also have a reduced corona, though it is recognizable.

**T. carneata** new species,

Light flesh color. Head and thorax dulled by fine white and blackish dusting. Palpi hairy, regularly tapering toward tip of second joint, blackish on outer side. Fore wing with the flesh tint intensified toward margins, very lightly flecked with scattered fuscous scales. Ordinary lines absent, all markings being of spots. T. a. represented by obscure dashes on Cu and A; orb a dot; ren. a vertical bar, with a suggestion of division into two thick spots; t. p. a series of dots, parallel to outer margin; five of the dots ( $R_5$  and  $M_1$ ,  $M_3$  and  $Cu_1$ , A) stronger, and those above  $R_5$  absent. Outer margin with a little more blackish dusting, but no t. l. Hind wing white, less transparent than in most South American Agrotids, R and  $M_1$  strongly stalked (as also in *T. strigata*, but unlike most Agrotinae). 27 mm.

Lassance, Minas, Brazil, Nov. 15, 1919, R. G. Harris. Type in coll. Cornell Univ. Type no. 1243.

This completes the first *Agrotis* group. The second seems much more characteristic of the Chilean subregion, being relatively richer there than elsewhere, and as remarked is probably more or less a group of relicts. The only principal type of the group absent from South America is the Holarctic *Diarsia*, which has the distribution of the third group and approaches it in structure. No South American *Ochropleura* is at hand, but *vibora* must certainly belong to it.

The most striking characters of the group are the preservation of the digitus and Hadenid neck, but the forms are varied, and many have lost one or the other. Where in the *Agrotis* group it is difficult to find distinctions good enough for species, in this group each species examined (outside of *Diarsia*) is almost distinct enough for a genus. For the present, *Peridroma*, which seems to be the oldest name, will be used in an inclusive sense.

*Peridroma (Peridroma) margaritosa* Haw. (figs. 22, 30). This is an isolated species, worthy of a subgenus, and possibly a genus. The genitalia are figured by Pierce, pl. 18 (as *saucia*), also the valve and clasper in Smith, Bull. U. S. Nat. Mus. 38, Pl. 3, fig. 29. A specimen from Lima is typical in markings and structure, but it is possible that genitalic examination may show the Chilean *P. semifusca* is distinct. *P. ochronota* is a mere color form, present also in North America. In any case the species is closer to the South American *Hemieuxoa* complex than any other, and has probably spread in modern times from South America.

The next few species would belong to *Hemieuxoa* of McDunnough, or are transitional to *Anicla*, having the appearance of *Anicla* without its unique genitalic features. The first few species have a digitus, like typical *Peridroma*, though it is very small in *H. rudens*, and was overlooked by McDunnough, while the last two, which superficially resemble *Anicla*, have also lost the digitus. *Euagrotis* McD. also belongs to this immediate group.

*P. (Hemieuxoa) rudens* Harv. (figs. 23, 33). This species is from North America, and is figured to show the small digitus, overlooked by McDunnough. This is the most specialized species, with the deeply forked clasper and lobed saccus. The penis has two spines. McDunnough's assumption that *rudens* and *pellucidalis* are dimorphic forms is confirmed by the presence of parallel dimorphic forms of the Lima species described below.

*P. (H.) conchidia* Btl. Through the kindness of Mr. Tams, I am able to figure a specimen from the British Museum, of the type lot (figs. 24, 32). The fork of the clasper is short, and terminal, the digitus is much stronger, and the lobing of the sacculus is overshadowed by a great widening of the base of the clasper. The conspicuous part of the clasper in this and the following species is the morphological equivalent of the true clasper as distinct from the ampulla, corresponding to the lower fork of the clasper in *Euroa* and *Chorizagrotis*, and the bluntly rounded lower lobe in *Peridroma* proper, in *rudens* and *microstigma* it is the ampulla. Penis with 2 spines. I have seen only the type lot of this species, which resem-



bles the following remarkably in superficial characters. No specimens with black in the cell are known.

**P. (H.) polymorpha** new species.

Closely similar to *P. (H.) conchidia*, but duller, and without the yellowish shading beyond the cell and in the sub-medial region, etc. Dull fuscous, with scattered black scales, and faintly mottled in lighter and darker shades. Head and thorax concolorous but heavily frosted with fine white scale-tips. Antennae with shaft darker and scape paler. Fore wing with the veins a little brownish, and more flecked with black and white, but not at all contrasting. Ordinary lines double, blackish, wavy and interrupted on veins, varying from distinct to practically obsolete. Basal line of lunules at costa and below cell, apparently less oblique than in *conchidia*; antemedial regularly wavy; post-medial sinuous out beyond cell and concave below, normal, usually very faint; subterminal irregular, pale and interrupted, sometimes obsolete; with a dark shade at costa before it, and with more or less of a dark shade opposite cell beyond, sometimes just crossing the line, and often obsolete; t. sp. sometimes more diffusely dark, or with a separate weaker dark shade at anal angle. T. line black, broken into dots between veins, and a gray line in fringe broken into dots opposite veins. Orb. small, round, dark gray, sometimes contrasting, encircled with luteous mixed with bright buff scales, and then with blackish, reniform similar, blunt kidney-shaped, extended at lower angle, usually similarly outlined except at the lower outer extension, which is plain. Hind wing translucent white; shaded broadly toward margin with light fuscous, and with light fuscous veins. 28-33 mm.

The species is highly variable and shows the same dimorphism as *H. rudens*. In two specimens the tegulae and costal portion of the fore wing are heavily infuscated except for the pale apex, as in *P. margaritosa* f. *ochronota*; in two there is a slender black basal dash and bar connecting the orb. and ren. along the lower edge of the cell, and a narrow black stripe on the collar, in one the basal dash is heavy, the black in the cell takes the form of thick spots both before the orb. and beyond it, and the bar on the collar is heavy. This last corresponds to the *rudens* form of *H. rudens*. In this specimen the usual transverse markings are almost lost.

Male genitalia (figs. 23, 31) substantially smaller in proportion to the size of the moth than in the other species examined; uncus with a little double tuft of terminal spines; valve with hadenid neck

strong, much broadened at the end with corona of only about 8 spines toward its costal side; lobe of sacculus rounded over, not prominent; clasper extremely modified, the costal lobe (the one which is forked in *rudens*) reduced to a short blunt prong, but the dorsal one much enlarged and scoop-shaped, with concavely truncate end; digitus weak, though larger than in *rudens*, and overlapping costal edge of valve; juxta unarmed, penis with a single strong spine. The lower prong of the clasper is usually visible without dissection and identifies the species immediately.

Desert side of western Perú. Type male from Lima, May 14, 1920, at light in city, in coll. Cornell Univ., type no. 1244; paratypes from same lot and till May 21; also from Chosica, May 25, and Matucana, May 12; the specimen with dark costa was taken at Lima, May 19, the two forms with black in the cell also at Lima, May 20. This is the commonest agrotid moth of the area, and we also have it from H. S. Parish, collected at Lima in 1914.

*P. (H.) microstigma* Schs. This species has been seen only in the fully marked *rudens*-like form. The male genitalia (figs. 26, 34) are again quite unlike the other species in the form of the clasper, the upper lobe being slender, oblique and simple, and the lower represented only by a bluntly pointed extension of the whole clasper; sacculus with a hairy lobe on its dorsal edge; corona nearly lost, the hadenid neck nearly lost, and dorsal lobing in the sacculus completely smoothed out, digitus very large, nearly reaching tip of valve, uncus long and slender, and penis with four spines.

*P. (H.?) messia* Guen. This species, which superficially can hardly be separated from *infecta*, is entirely different in details of genitalia (figs. 27, 35), in fact is as close to *Hemieuxoa* as to *Anicla*. The little tuft of spines on the tip of the uncus suggest *Hemieuxoa* and the hadenid neck is well formed, but the digitus is absent, being replaced by a slight chitination on the surface of the valve, which is found in various other forms; the clasper has a single free end, somewhat scoop-shaped and truncate, but from its attachment obviously distinct from the larger scoop of *H. polymorpha*. Penis with three spines. This species differs from *Anicla infecta* among other things, in the normal uncus, normally proportioned valve, with much stronger clasper, absence of the lobe on sacculus and loss of the clavus. In all but the last of these *infecta* is more specialized.

I have another species received as *ferruginescens*, which is probably correct, but lacks the black bar on the collar used by Hampson as a key character. Its genitalia are substantially as in

*messia* (figs. 28, 36), but the clasper is simpler and the corona weaker.

*P. (Anicla) infecta* Ochs. Separate from all the preceding by the enormously exaggerated uncus and valves, but more primitive in preserving the clasper. The resemblance to *Euagrotis*, which is apparently purely North American, suggests that this species also may have originated in North America. South American specimens seem on the average less gray than northern ones, but the difference is only statistical, and there is no difference in the genitalia, which are figured by McDunnough, p. 42.

#### PSAPHARA Walker

Hampson sinks this genus to *Epipsilia*, a member of the third main group of Agrotinae. As McDunnough notes (p. 13) it has nothing in common with any of the northern types included in this conception,—it fact it belongs to group 2. It has a corona, hadenid neck, modified uncus, much as in *P. margaritosa* and *P. (Anicla) infecta*, and oblique clasper. The fore tibia is figured as simply spined (now missing from the type), tarsi with no upper row of spines, and antennae plumose. *P. coppingeri*, which is placed next to it by Hampson, is closely related, it seems, but the type has lost its legs; and it is likely that many or all the remaining South American "*Epipsilias*" will belong here. It is a distinct subgenus of *Peridroma* or perhaps a distinct genus.

#### Pareuxoa new genus

(type *Noctua lineifera* Blanch.)

Superficially with the structures of *Euxoa*, to the extent of having a raised ring on the front and serrate and fasciculate antennae, but entirely different in appearance and genitalic characters, in the latter definitely belonging to the second and not the first group of Agrotids.

Eyes naked, with rudimentary lashes; front with a raised ring; antenna heavily biserrate and fasciculate, vestiture smooth, hairy with a little flattened hair intermixed (unlike any true *Euxoa* known to me, the nearest being *E. bostoniensis*, which has a mass of loose fluffy hair); fore tibia strongly spined, the longest spine about  $\frac{1}{4}$  as long as the tibia; mid and hind tarsi without upper spinules (unlike *Euxoa*). Male genitalia (fig 16) with corona absent and apical portion much reduced, the digitus very large and extending well toward its tip; clasper oblique with its dorsal base much swollen, costa thickened, but without abrupt end

at base of clasper; uncus flat, hairy, truncate but not modified; tegumen with peniculi projecting as small free lobes; clavus absent, juxta with a central projection ending in a group of short heavy spines.

The genus may be separated from *Euxoa* in Hampson's arrangement by the smooth hairy vestiture and lack of upper spines on the tarsi; in fact it belongs to group 2, from all the other types of which the combination of spined juxta and lack of corona will separate it. It has no close relatives known, and on a tabulation of characters seems to come closest to *Mesogona* and *Pseudorthosia*, with neither of which it has any true connection.

#### NOTES ON THE CLASPER

In the preceding discussion I have followed the usual custom of using the term "clasper" in a somewhat inclusive sense. The material, in fact, gives a little clue to the true morphology of this group of structures. The clasper, in the broad sense, appears to be a definite appendage, or perhaps morphologically terminal segment of the valve, as is indicated by its independent muscle (fig. 24). This muscle always originates from inside the body-cavity, and sometimes, if not always, has fascicles also arising from the base of the valve, but both sets of fibres converge and are inserted at a single point, which is typically a separate sclerite on the inner face of the valve. It would seem best to consider this sclerite the true clasper, whether it is complex, as in many Noctuidae, or as in some Pieridae, is reduced to a mere chitinous rod. In the present group the primitive form appears to be a V-shaped chitinous base, to the notch of which the muscle is attached, and which terminates in two free processes. The more ventral normally continues the line of the muscle, and is the clasper proper (stippled in the series of diagrams, figs. 30 to 37); the more costal (solid black) is attached to the costal part of this base, and extends typically obliquely up and out. In this group it is similar in character, being a simple chitinous spike or hook, but in some Noctuidae it bears a tuft of bristles. Actually this is the structure called *ampulla* by Pierce.

In the Agrotinae the two free processes are only occasionally both developed, as in *P. (Hemieuxoa) polymorpha* (fig. 31) and *Euxoa*, with *Chorizagrotis*. Occasionally the true clasper only is found (*H. conchidia*, fig. 32), but it is much commoner for the true clasper to degenerate, as shown by the fact there is no projection opposite the muscle insertion, and then the ampulla to swing out



and down, and take the function of the clasper;—in which case it commonly gets the name of clasper as well, as in *Agrotis* and several genera related to it. It is interesting to note in following through the series of *Diarsia*, *Ochropleura* and *Noctua*, that in this series the true clasper has not degenerated directly, but has moved down to the edge of the valve, and then out toward the apex. By following out the series it is clear that the organ called “pollex” in the *Noctua* group is truly the clasper, while the organ that is considered the clasper, is morphologically the ampulla. Finally in a few species, the ampulla regains its character of a transverse hairy process, as shown by various species of *Rhynchagrotis*, and *Triphaena pronuba* (Pierce, Plate 15).

Of course the line of development may be quite different in other subfamilies of the Noctuidae, some of which have a perfectly normal ampulla (e.g., *Leucania turca*, Pierce, pl. 6). The case of the hairy-eyed types is specially obscure (fig. 10), but my suspicion is that the more costal process, which has the muscular attachment is the true clasper, and the more ventral is either the ampulla which has passed under it, or more probably really the digitus.

POSTSCRIPT: Some additional material and study serves to round out certain points.

Of the forms along the boundary, *Timora* and *Adisura* are normal Heliothines, but *Copablepharon* is very close to *Agrotis*, in fact hardly a subgenus. *Actinotia* shows a general Agrotine character, but is generically distinct; it has most of the characters of *Anomogyna*; but with a well developed corona, and perhaps comes from the main stem of group 3.

A number of further forms from South America were examined and most of them go to *Hemieuxoa*, but with very strong specific characters. *H. strigata* and *lacteicosta* are normal; *strigigrapha* and *tiniloides* have lost the corona, and *mendosica* has a double uncus. All show the double cluster of spines at the tip of the uncus, like the other *Hemieuxoas*. *Ignicans* is a normal *Anicla*, but very distinct from *infecta*; while *leucanioides* is nearest *Anicla*, but aberrant. “*Episilia*” *rufisigna* turns out to be a true *Peridroma*, though of course very distinct from *margaritosa*; and still more definitely indicates South America as the home of that genus. *Agrotis trisignata* is a true *Agrotis* in the broad sense, but about equally distinct from *Mesembreuxoa*, *Feltia* and typical *Agrotis*.

Several forms from temperate Central Asia go in group 3. "*Lycophotia*" *alpestris* is a *Caradrina* in the sense of McDunnough but leaning toward *Chersotis* and *Lycophotia*. "*Epipsilia*" *junonia* is a *Chersotis*, leaning toward *Caradrina*; and *E. canescens* lies between *Graphiphora*, *Hiptelia* and *Pachnobia*, filling the very small space between them. "*Epipsilia*" *juldussi* is a more aberrant type, and comes nearest to showing the characters of *Ochropleura*. At first glance it gives the curious impression of a mixture of *Agrotis* and *Pachnobia*.

Two forms from the Australasian region are now available. *Agrotis innominata*, which Hampson transferred to *Lycophotia* for some obscure reason, is a true *Agrotis*, and not far from the typical group. *A. compta*, which would at first glance be taken for a mere variety of *Noctua baja*, turns out to be an aberrant *Diarsia*. As these two forms are fairly representative of the Agrotids from the Old World Tropics, it seems not improbable that groups 3 and 4 will be as completely absent from the Old World tropics as they are from the new. They seem to be a modern North Temperate development, which has not yet had time to reach its full possible distribution.

#### EXPLANATION OF FIGURES

Except where otherwise stated the figures show the male genitalia spread out in ventral view with the left valve removed, and the penis drawn separately and to the same scale. The separate figures are not to scale, except the series on the clasper (figs. 30-37). The valves are drawn as accurately as possible in flat side view, but the tegumen-rings are only partly indicated, showing the distortion resulting from mounting in most cases. The uncus is generally turned to show a side view.

#### PLATE I

- Fig. 1. *Mesogona acetosellae*, France  
 2. *Ammoconia caecimacula*, Vienna  
 3. *Cyrebia anachoreta*, Europe  
 4. *Epipsilia griseascens*, Europe  
 5. Genealogy of the *Agrotis* group. The vertical distance indicates roughly the degree of specialization, 3 mm., representing roughly one tabulated difference from *Protogygia*